ITEM NO.: 6
DATE: May 26, 2000
CONTRACT NO.: 96-324

STAFF EVALUATION OF A DRAFT RESEARCH FINAL REPORT

TITLE:	Assessment of the Effectiveness of Room Enclosures with Ventilation Systems in Reducing Risk at Dry Cleaning Facilities Using Perchloroethylene
CONTRACTOR:	AVES (formerly AeroVironment Environmental Services)
PRINCIPAL INVESTIGATOR:	Eddy Huang, Ph.D.
AMOUNT:	$165,000
DURATION:	21 Months

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I. SUMMARY

Perchloroethylene (perc) is a toxic air contaminant and human carcinogen. It is the solvent used by the great majority of dry cleaners and the dry cleaning industry is the largest user of perc in California. California's Health and Safety Code requires that a facility identified as posing a “significant risk” to the public by an air pollution control district or air quality management district must develop and implement a plan to reduce its risk below the significant risk level set by that district. One of the risk reduction measures identified by the California Air Pollution Control Officers Association (CAPCOA) dry cleaning workgroup is the use of room enclosures with ventilation systems.

In this study, the contractor obtained data on and documented the effectiveness of room enclosures with ventilation systems in reducing risk to the public at dry cleaning facilities that use perc. The contractor also developed guidelines for the dry cleaning industry on room enclosure design, installation, operation, and risk reduction potential. The resulting information may help the dry cleaning industry reduce the risk of public exposure to perc emitted from their facilities.

II. TECHNICAL SUMMARY

Objective

This project had two objectives. The first objective was to obtain emissions data for estimating perc capture efficiencies for the types of room enclosures currently in use, both those with and without emissions controls (such as carbon absorbers). These capture efficiencies would later become an input parameter to the industry-wide risk assessment model, which is used to estimate the health risk posed by these facilities. The second objective was to develop a set of guidelines for the dry cleaning industry on the use of room enclosures as a means of limiting public exposure to perc.

Background

In 1991, the Board identified perc as a toxic air contaminant. People are being exposed to unhealthy levels of perc, contained in emissions from nearby dry cleaning facilities. In 1993, the Board adopted an airborne toxics control measure to reduce perc emissions from dry cleaning operations, based on an ARB assessment of the dry cleaning industry. As a result, facilities with emissions identified by an air district as posing a “significant risk” to the public must implement a plan to reduce their emissions below the “significant risk” level.

Dry cleaners usually have either natural or powered ventilation systems installed at their facilities. Emissions from these systems are released at ground level or on rooftops. An "enclosure system" contains and captures emissions from dry cleaning machines, draws these emissions to a stack on the roof, and disperses them into the air. Enclosure systems can be equipped with emissions control systems, such as a carbon absorber, to reduce perc emissions. Whether these vapors are dispersed or captured, enclosure ventilation systems can result in reduced perc exposure to workers and people near the facility.

Dry cleaning facilities use various types of enclosure/ventilation systems. A "local ventilation system" consists of a hood mounted directly above the dry cleaning machine. The hood is ducted to a fan, which exhausts to a stack mounted on the roof.

The local ventilation system is considered to be more effective in capturing and dispersing perc from the environment within the facility than either the natural or powered ventilation systems.

"Room enclosures" surround the dry cleaning machine, either fully or partially. A room enclosure has a ventilation system consisting of a fan ducted to a stack on the roof. "Full vapor barrier rooms" are large enough to completely enclose a dry cleaning machine and allow room for the operator and other personnel performing the cleaning or maintenance and repair work. "Partial vapor barrier rooms" confine the top, sides, and back of the dry cleaning machine, leaving the front panel exposed for convenient loading and unloading of the clothes. A dry cleaning workgroup with district and industry representatives identified the use of room enclosures with ventilation systems as a possible risk reduction measure.

Project Summary

The contractor for this project was AVES (formerly AeroVironment Environmental Services), which is now an affiliate of ATC Associates, Incorporated. AVES was assisted by its subcontractor ERMI and by staff from the Bay Area Air Quality Management District.

The project consisted of several tasks.

- Site Selection. Nine test sites that used ventilated room enclosures or local ventilation systems were selected for evaluation. Three has local ventilation systems, three had partial vapor barrier rooms, and three had full vapor barrier rooms.
- Test Protocol Development. A test plan was developed for sampling and analysis of perc in the waste stream, ventilation systems, clothing, lint, and ambient air inside the facilities.
- Measurement of Capture Efficiencies. Samples were taken from the stack, cartridge filter, wastewater, fabrics, lint, and sludge, according to standard test methods. The amount of perc consumed by each dry cleaning machine was determined, as well as

the amounts of perc in the wastestreams. Many field observations were noted. Based on a mass balance approach, capture efficiency was calculated for each facility, and subjected to statistical analysis. The perc capture efficiency of a ventilation system was defined as the percentage of the stack emissions divided by the total amount of stack emissions and indoor air emissions.

- Dispersion Modeling and Risk Reduction. The capture efficiency data and facility emissions rate was entered into the U.S. Environmental Protection Agency's ISCST3 dispersion model, which was then used to estimate the downwind concentrations of perc from each dry cleaning facility. The associated risk was determined, using the dispersion modeling results and risk assessment parameters obtained from Cal/EPA's OEHHA.
- Guidelines for the Installation of Room Enclosures. Based on the evaluations and modeling results, AVES developed guidelines for dry cleaners to use when considering room enclosures with ventilation systems. These guidelines contain specifications for room enclosures; information about methods of installation and kinds of control systems; costs associated with purchasing, installing, and operating the different types of enclosure/ventilation systems; and estimates of the capture efficiencies of these systems and their risk reduction potentials.
- Conclusions and Recommendations. AVES found that additional cancer risks were generally highest for facilities with natural ventilation and lowest for facilities with total or partial room enclosures. AVES recommended improved housekeeping, inspection, and maintenance to minimize spills and leaks, reduction in opening of the cleaning drums, guidelines for cleaning muck cookers and pans, improved procedures for solvent delivery, and training to reduce spills.

III. STAFF COMMENTS

A preliminary draft final report was reviewed by staff of the Research, Planning and Technical Support, Monitoring and Laboratory, and Stationary Source Divisions, as well as by staff from the Bay Area Air Quality Management District. Over 20 pages of comments were submitted to the principal investigator, who made significant changes that are reflected in the draft final report currently under consideration.

(NOTE: Due to its length and specialized nature, Appendix B (Modeling Output) has not been included with the report provided to the Committee. It is available by e-mail, on request.)

Detailed comments on the draft final report are as follows.

Executive Summary: This summary should refer to problems encountered during the study that limited the level of confidence for the expected capture efficiency for each type of ventilation system. Some of these problems are mentioned on page 6-5.

Section 3.3.1: Please identify the laboratory and report all volumes, weights, and analytical results. Indicate whether the wastewater reservoir was emptied before testing began or how the wastewater generation rate was determined. Explain "composite samples" taken when sludge production was low. Indicate how samples were refrigerated during shipping.

Page 4-1:

- The report indicates capture efficiency was determined by calculating a mass balance. However, the U.S. Environmental Protection Agency recommends using a temporary enclosure to directly measure fugitive emissions. Explain why "before and after" testing (direct comparison of concentrations in shop area with and without the ventilation) was rejected.
- Is the calculated fugitive emission for fabrics representative of actual residual solvent in the batch of clothes processed during the test? Should perc from clothes be considered as fugitive emissions? Please justify whether the total fugitive emissions should be considered equal to the combined emissions from clothes, stack, and air.

Table 4-2: Explain "Source Test Total" and describe calculations used to determine the data in this table.

Section 4.2, Field Observations: Regarding Facility 3, describe how the sludge waste container was sealed. Discuss chain of custody for sludge at Facility 6. Expand discussion of sludge sampling at Facility 7. Indicate how the "sludge bin" was sealed at Facility 8 and approximate age of material sampled. Describe sealing of sludge drum at Facility 9.

Page 4-7: Regarding air change rates for the room volume outside the enclosures, does the air outside the enclosure go through the stack as well? How might this affect modeling protocol or procedures? Explain how the smoke tests and Draeger tubes were used to determine air change rates.

Section 5.0:

- Provide a short description of the ISCST3 dispersion model, with enough information that others can duplicate the work.
- Explain how the risk from local ventilation compares to the risk from use of enclosures, considering their various ventilation arrangements.
- Explain the decision to model only eight of the nine sites. Describe the nature of site-specific data input to the model and indicate how data other than test data were obtained, such as building geometry.

Page 5-1: In the last sentence of the third paragraph, it is stated that risk reduction potentials are calculated as a percent reduction in risk. Please include this calculation.

Page 5.3: In the second sentence under Scenario 2, it is stated that an emission factor of 0.01 is used to estimate the perc emissions. Explain how much this might vary among facilities.

Section 6.2.2: Include an estimate of the cost to operate the motor-driven fan for a dry cleaning enclosure; this may be a significant cost. This estimate should consider the hours of operation and motor size.

Page 6-3: In the second sentence of the second paragraph, it is stated that the secondary control system has a small carbon adsorber. Please note that the carbon adsorber for the fugitive control system is also relatively small.

Section 7.0 Conclusions: This section should discuss the extent of uncertainty in the conclusions that results from the problems encountered during the study.

Section 7.0 Recommendations: Please justify recommendations if possible, perhaps by referring to reported observation of field conditions. Also, define the term “muck cooker”.

Appendix B, Modeling Output: ARB staff received a revised air dispersion analysis at the same time that the draft final report was mailed to the Research Screening Committee members. ARB staff plans to review the latest analysis to determine if it suitably addresses concerns that had been indicated regarding the preliminary draft. This will include a review of the input data to represent worst-case meteorological conditions and the adequacy of the documentation.

IV. STAFF RECOMMENDATION

Staff recommends the Research Screening Committee accept this draft final report, subject to inclusion of appropriate revisions in response to the staff comments, and any changes and additions specified by the Committee.